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AUTHOR Mitchell, Evelyne
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ABSTRACT

Scotland's vocationally-oriented Napier College was funded by the French Government to develop language courses for scientists and engineers. The courses developed have been intensive and extensive, based on work started by a team of French scientists focusing on the language, concepts, and ways of thinking common to the scientific community. Instruction prepares students for the Paris Chamber of Commerce certification examination for scientific and technical professions, and emphasizes the specialized and unique characteristics of scientific and technical language use, including grammar, syntax, and discourse structure. An experimental course designed in France for a variety of foreign scientists was chosen for the core of instruction. The method uses a process similar to scientific inquiry, in which the participants make observations in controlled conditions. The materials consist of a dialogue of realistic interactions of professionals, a filmstrip of pictures for observation and description, a vocabulary list, and teacher's guides. Other materials are being collected for program use. Guest scientists are invited to speak to the classes. Experience to date suggests that the kind of target audience requires a different instructional approach and provides different opportunities than does the traditional adult language-learning group. Interest in the courses is increasing. (MSE)

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TEACHING SCIENTIFIC AND TECHNICAL FRENCH AT NAPIER
COLLEGE IN SCOTLAND

Evelyne Mitchell

Language Department
Napier College
Collington Road
Edinburgh EH 10 5DT
Scotland

44 31 447-7070

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Scotland has been associated with France for centuries. Although the 'Auld Alliance' Treaty of 1295 is no longer binding, the cultural ties are very strong and the academic reputation of its capital, Edinburgh, as a center of scientific excellence, means today that a large number of organisations co-operate with French partners.

In the academic session 1982/83 Edinburgh was chosen by the French Government to be the pilot center in Britain for developments in the teaching of French to scientists and engineers.¹ Napier College, a vocational Higher Education college, built around the house in which John Napier, the inventor of logarithms, lived in the 17th century, was thus initially able to develop courses in French for Science through the financial assistance of the French Embassy.

In 1985, as a result of some initial success, Napier College was chosen by the Paris Chamber of Commerce as the first center in Europe for the 'Certificat de Français des professions scientifiques et techniques' and next June candidates from educational and industrial organisations will sit this new examination for the first time.

The extent of the co-operation between French and English speaking scientists is likely to increase in the present spirit of the European community. This growing awareness that international collaboration is going to become the best way of pursuing scientific endeavours in many fields should lead to greater efforts towards foreign language training for scientists.

Apart from the obvious need for various people working with colleagues in France to speak French, the need for British scientists to be able to communicate with others through French has been made clear in our classes over the years. We have had for example a research officer needing to speak French on her visits to laboratories in Morocco, a zoologist who needs French when visiting Gabon, and a member of a

European organisation who needs to speak French to those delegates who share French rather than English as a common language.

As for conferences where interpreters might be expected to eliminate language difficulties, communication is often still a problem. Interpreters sometimes fail to convey the quality of the arguments and even, at times, the substance because of the extreme complexity both of the subject matter being discussed and of its formulation.

Moreover, it is at times difficult to provide interpreters because of their scarcity and the cost of their services. Besides, is it not in fact often in the coffee room or over dinner that the most important ideas are exchanged or decisions made? Working relationships are always enhanced on such social occasions by the willingness and ability of foreigners to use the host country's language.

Up until 1982 the Scottish based scientist, doctor or engineer who wanted to improve his French to communicate with colleagues had at his disposal the usual range of courses always planned by language specialists alone, and geared to achieving general purpose linguistic competence only.

Since 1983 Napier College has been offering extensive and intensive specialised courses of French for Science and Technology. Our approach has been based on the work started by a team of French science lecturers focusing on the language, concepts and ways of thinking common to the scientific community at large. Our aim has been to achieve more than mere linguistic competence, but I will deal with this in more detail later.

Since October 1985, our teaching has incorporated some preparation for the Paris Chamber of Commerce 'Certificat de français des professions scientifiques et techniques' and we are hoping to continue to link our teaching to this new examination since both share the same objective of

facilitating communication in a French professional context without concentrating on the specialised vocabulary of particular disciplines.

In an effort to achieve a good return on investment of the scientist's time, a commodity which is always in short supply, our approach builds in a new way on their existing foundation of fundamental French structures.

Some linguistic competence is certainly a basic requirement for entry to our course and working towards communicative competence will mean, it is true, that the learner will be able to use the language more effectively at an appropriate level in a predictable situation. However, we aim for them to go beyond these levels of competence and we look for the ability to deal with the unpredictability of the whole process of communication.² The ultimate goal must be for the learner to understand a statement or a question he has never heard or read before and be able to formulate his answer by combining elements of the target language in a way he has never done before, using what Pottier calls 'la phraséologie combinatoire'.³

Traditional courses often made the assumption that there was no real difference between the language of science and that of every day informal use. If this was the case, would the Institute of Biology examination in Britain have concentrated in the late seventies in part on an ability to communicate in scientific English, and would three leading French scientists have published a book in 1985 for French students entitled 'La communication scientifique'?⁴

The belief that if you can communicate in every day situations you should be able to communicate in professional situations has left many a scientist unable to bridge the gap between the everyday use of French and its formal use in a scientific context. Although reasonably knowledgeable about the phonology, morphology, syntax and lexis of French, he still finds himself unable to discuss scientific ideas in French. This problem arises from the nature of scientific communication.

On the lexical level the scientific register ignores emotive and aesthetic terms of the common language,⁵ but makes extensive use of its greek and latin terms. On the syntactic level the scientific register is found⁶ to be more restricted than the common language one. This reduced syntax on the one hand uses means of neutralising the subject and exalting the object, such as the use of passive, impersonal and pronominal expressions as well as nominalisations, on the other it uses means of expressing important notions in scientific communication, such as cause, condition, consequence.

Various researchers have analysed the linguistic content of scientific communication both within one language and between different languages. The length of the scientific sentence was compared in English, Russian and French;⁷ it was found to be of an average of twenty nine words. If we concentrate on the English and French languages, we find this long sentence shows recurrent characteristics of impersonality, objectivity and logical reasoning.

The impersonal feature of the scientific sentence is revealed by the absence of personal pronoun, "je" becomes "on". The extensive use of the passive form is another illustration of the impersonality of the scientific sentence; "I separated the liquids" becomes "the liquids were separated". This tendency to get passive constructions is shared by English and French.

The objectivity of the scientific sentence is revealed by its many nominalisations; thus the transformation of "I separated the liquids" to "the liquids were separated" to "the separation of the liquids" illustrates the gradual process towards impersonality and objectivity. We notice the person of the scientist is not important, it is the experiment itself and its results that matter.

Finally this long impersonal objective sentence needs a logical articulation if it is to satisfy the demands of clarity within a complex argumentative function. Devices of

cohesion and correctives like "firstly" "moreover" "such as" are particularly frequent and important in a tight logically developed scientific discourse.

Our experience at Napier has confirmed that the scientist needs a firm grasp of discourse markers, indicating in particular, logical sequencing and contrast. He needs an ability to talk abstractly about generalisations, to describe relationships and also an ability to express quantities, differences, probability and hypotheses.

In the case of the French language, the English speaking scientist will need to adopt its characteristic tendency towards abstraction. Besides French is a language where the imprecision of the utterance betrays the imprecision of the thought expressed and this is a situation the scientist cannot risk finding himself in.

The recognition, however, that there is a particular linguistic core to take into account in a course of French for Scientists could lead linguists to center their material production round its existence and also round a needs analysis of the Munby type;⁸ such course content might be too restricted and too predictable.⁹ Could the cooperation of a linguist with a technical or scientific specialist as well as a psychologist achieve a more balanced course? This remarkable cooperation was in fact achieved in the university of Montpellier in France. Through an association formed initially with the Language Department of Napier College some staff were trained to use the French course, FONDAMENTALEMENT, developed by this team (co-ordinated by M. Jan Janecek, Centre de recherche sur l'information et la communication, Universite de Paris I, Pantheon-Sorbonne).

When the opportunity arose to exploit the teaching of French in science courses, it was decided to use this experimental course that had been produced for a variety of foreign scientists, and to evaluate its effectiveness with our English speaking scientists.

We were attracted, in the French experiment, by the combination of the following elements:

1. it was started by a team of medical and science lecturers from various disciplines,
2. it was finalised by a team of psychologists and experts in teaching French as a second language,
3. it concentrates on the language items common to most scientists (V.G.O.S.¹⁰ frequency list as a lexical basis),
4. it concentrates on concepts common to most scientists, (like sampling, magnification, separation),
5. it allows the learners to negotiate meaning in a class situation where they tend towards an objective and precise expression of their thoughts,
6. it is learner centered, allowing the interaction to take place between learners in their real roles as experts in their fields and in real authentic communicative situations, unlike role playing in artificial situations where language is too predictable.

As far as methodological principles are concerned the French approach shares with the notional functional approach¹¹ the belief that language learning is learning to communicate and that negotiating meaning is of prime importance. It is through the struggle to communicate that the target linguistic system will be learned and trial and error will lead to learning, motivation coming from what is being communicated.

As for the method itself, it makes use of a process akin to scientific inquiry whereby the scientists make their observations under controlled conditions in their attempts to formulate or restructure their models of the world around them. In this process they often go from the particular to the general in a way which I will demonstrate later.

The teaching material consists mainly of a dialogue and a filmstrip. The dialogue usually involves three people, a technician, a specialist and the head of a laboratory who will

interact according to their different status and knowledge as they would in a real life situation. They discuss the aim of an experiment, the choice of material or technique, the experiment itself and the results.

The corresponding film strip shows sequences of three types of pictures; the first one is a photograph of a technician handling a tool or a machine meant to lead the learner to describe the object but also to question the meaning and implications of the technician's gesture. The second one is a diagram or a formula representing the principle behind the experiment. These diagrams always consist of 3 designs in order to encourage the expression of comparisons and relationships. The third one is a non scientific drawing, often humorous which represents a general idea behind the situation.

The learners are asked to observe the photographs and describe them as precisely as possible with the everyday French that they possess. Then with the diagrams, they have to move from the particular to the general and acquire the objective language of generalisation. Finally with the cartoon they can leave the context of the lesson and express an idea related to their own field of expertise, with precision and objectivity, as I will demonstrate later.

Besides the above mentioned audiotape and filmstrip, the teacher managing the class has a vocabulary sheet giving the terminology required for the lesson, a booklet providing a guide to the language input to be used and taught and also a smaller text giving the scientific content of the lesson.

A word should be said perhaps about the teacher whose purpose is never to teach science but to improve the quality of the language used in class. The tutor is a referee in the class discussions, triggering them and making sure communication is not barred by loss of meaning among the participants.

This role of facilitator¹² of learning in a class where the learners partly control discussions requires certain qualities from the teacher. He or she must bring a great language expertise and at the same time be prepared to make use of the learners' expertise in their own fields. Training teachers in this new facet of the art of teaching is certainly considered essential by the developers of the method.

In adopting this method for our English speaking learners, we have, at Napier, made some innovations. These include the integration of a scientist in a team teaching situation and the addition to the visual and auditive inputs of a kinesthetic dimension. We have organised mini experiments in class in the fields of the learners. These, prepared by scientific colleagues, give the learners an opportunity, while handling equipment, to make further use of a newly acquired aspect of the language and internalise their understanding of the linguistic system.

We are also building up a stock of written materials, both from specialised publications like 'La Recherche' and from popular magazines like 'Science et Vie'.

As for authentic sound material we are collecting audio and video tapes, consisting mostly so far of interviews with French scientists and also recording by our scientific French language assistants. These, in addition to the existing material we already have in the 'Learning by Appointment Unit' of the college, will be part of a Distance Learning Package for those who may not have the time to attend all our classes.

Access to specialised terminology has been improved by the purchase of a large number of multilingual dictionaries in most scientific disciplines.

To encourage practice of the target language in a natural communicative situation, we have invited, whenever possible,

French scientists working in Edinburgh to come and talk to our class about their work. There is no doubt that talking to an engineer from the French firm MATRA and understanding what he does for the project in connection with the Scottish firm FERRANTI has made European space collaboration a definite reality for the group.

In order to make up for deficiencies in everyday French, participants can attend a course in general French along with one in French for Science.

Having adopted the French team's methodology, we are currently evaluating their method's effectiveness at two levels - at class level and at the individual student level where 4 self selected learners have been studied in depth. The formative evaluation carried out this year relies on questionnaires, interviews and language tests as well as class observation. It is unfortunately too early to have definitive results from the existing data being collated but the present analysis, although incomplete, tends to point to the following:

1. by exploiting the characteristics of the scientists personality eg their keenness to query, argue and be right, we greatly avoid the low self-image syndrome so common among adult language learners,
2. by making use of the learners' thought patterns eg their rigor, logic and objectivity we place them in a familiar type of learning situation thus avoiding frustration,
3. by using the learners' habitual non-verbal communication devices eg their graphs, photographs, diagrams, we allow them to think freely in space while helping them to speak in the time constraint of discourse,
4. by ignoring some errors in the learners' productions we boost their confidence and let them concentrate on fluency in the expression of meaning,
5. by stimulating the learners in class interaction, eg discussions on scientific concepts, we motivate them to construct their own response,

6. by using French produced materials we facilitate the learners' passage from English into French as a means of entry into the French scientific culture.

Preliminary analysis of the questionnaires dealing with student reactions to the course appears to indicate that the success of the group dynamics depends on the homogeneity of the group, as far as their level of French is concerned and its diversity, as far as their disciplines are concerned.

The ideal class would seem, according to the interviews analysed so far, to consist of a multidisciplinary group (for cross fertilisation) sharing the same knowledge of French to start with (for a rich garden soil) managed by a vigilant, motivated teacher (for seed-throwing and pruning) helped by a breeze of humour (for sparking off reactions).

The following selection of class productions triggered by the humorous drawing of a damp attic will, I hope, illustrate the progression achieved within one lesson - the situation was soil sampling in a forest.

The group had observed a photograph of a person taking a sample of soil, and said for example "l'homme tient le sac ouvert". Then after seeing the diagrams of 3 types of soil they had said for example "la couche superficielle se compose de matières organiques". Finally with the cartoon of the damp attic, they were able to express themselves in their own field with more precision and objectivity, saying for example:

"les plantes à la surface sont caractéristiques du sol en profondeur" (biologist),

"Les algues poussent maintenant à Edimbourg sur les façades; leur présence est due à la pureté de l'air" (ecologist),

"Le climat écossais, du fait de son humidité et de sa température relativement faible, est très favorable à

- la prolifération de champignons variés."
(entomologist),
- " Dans le domaine médical, la peau entre les doigts de pied peut aussi être affectée par des champignons"
(doctor),
- "Dans le domaine du bâtiment, il y a un champignon particulièrement dangereux. L'absence de circulation de l'air favorise son expansion." (civil engineer).

I should mention that this exciting experiment of teaching/learning French for Science in Edinburgh has been greatly facilitated by a number of favorable circumstances within Napier College. At college level, a post of researcher (my present one) was actually created in the field of teaching French to Scientists and engineers; this new post, funded by the college, was supported by the 2 faculties of Science and Technology at a time of financial restrictions in the British Educational System.

Another reaction within the college has been the establishment of a 'French Unit'; this voluntary 'club' whose aim is to encourage and support technical and scientific French language expertise in the college and consolidate existing and develop new contacts in French speaking countries, is chaired by the Dean of the Faculty of Technology, and more than half its members belong to the science and technology faculties.

At departmental level the supervisor of the research project is a scientist and the fact that the Biology Department has asked me to give a seminar is a token of their interest in our work for which they have allocated staff help.

Finally we have been fortunate in ensuring that one of our assistants who comes over from France for a year must be a science graduate; this has meant that he or she can be integrated into the team whose interest and good will has made this experiment possible.

Looking to the future, the establishment of Napier College

as a center for the new 'Certificat de français des professions scientifiques et techniques' of the Paris Chamber of Commerce will give the research team an added dimension to their work. An increase of interest is expected in our type of approach in the teaching of French to scientists.

It is hoped that the past and present cooperation between language and science specialists, whether in the planning of our method, in the teaching/learning that ensued or in the oral testing of the new examination where linguists and scientists share responsibilities, will lead to an increased number in the future of cases where scientists from two cultures will be able to communicate successfully.

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